

5. Temperatures.

In January, with mean temperature 36° and standard deviation in temperature 10° , a high temperature of 55° is almost 2 standard deviations above the mean. In July, with mean temperature 74° and standard deviation 8° , a high temperature of 55° is more than two standard deviations below the mean. A high temperature of 55° is less likely to happen in July, when 55° is farther away from the mean.

7. Final Exams.

- a) Anna's average is $\frac{83+83}{2} = 83$. Megan's average is $\frac{77+95}{2} = 86$.

Only Megan qualifies for language honors, with an average higher than 85.

- b) On the French exam, the mean was 81 and the standard deviation was 5. Anna's score of 83 was 2 points, or 0.4 standard deviations, above the mean. Megan's score of 77 was 4 points, or 0.8 standard deviations below the mean.

On the Spanish exam, the mean was 74 and the standard deviation was 15. Anna's score of 83 was 9 points, or 0.6 standard deviations, above the mean. Megan's score of 95 was 21 points, or 1.4 standard deviations, above the mean.

Measuring their performance in standard deviations is the only fair way in which to compare the performance of the two women on the test.

Anna scored 0.4 standard deviations above the mean in French and 0.6 standard deviations above the mean in Spanish, for a total of 1.0 standard deviation above the mean.

Megan scored 0.8 standard deviations below the mean in French and 1.4 standard deviations above the mean in Spanish, for a total of only 0.6 standard deviations above the mean.

Anna did better overall, but Megan had the higher average. This is because Megan did very well on the test with the higher standard deviation, where it was comparatively easy to do well.

9. Cattle.

- a) A steer weighing 1000 pounds would be about 1.81 standard deviations below the mean weight.
$$z = \frac{y - \mu}{\sigma} = \frac{1000 - 1152}{84} \approx -1.81$$
- b) A steer weighing 1000 pounds is more unusual. Its z-score of -1.81 is further from 0 than the 1250 pound steer's z-score of 1.17.

11. More cattle.

- a) The new mean would be $1152 - 1000 = 152$ pounds. The standard deviation would not be affected by subtracting 1000 pounds from each weight. It would still be 84 pounds.
- b) The mean selling price of the cattle would be $0.40(1152) = \$460.80$. The standard deviation of the selling prices would be $0.40(84) = \$33.60$.

13. Cattle, part III.

Generally, the minimum and the median would be affected by the multiplication and subtraction. The standard deviation and the IQR would only be affected by the multiplication.

$$\text{Minimum} = 0.40(980) - 20 = \$372.00$$

$$\text{Standard deviation} = 0.40(84) = \$33.60$$

$$\text{Median} = 0.40(1140) - 20 = \$436$$

$$\text{IQR} = 0.40(102) = \$40.80$$

15. Professors.

The standard deviation of the distribution of years of teaching experience for college professors must be 6 years. College professors can have between 0 and 40 (or possibly 50) years of experience. A workable standard deviation would cover most of that range of values with ± 3 standard deviations around the mean. If the standard deviation were 6 months ($\frac{1}{2}$ year), some professors would have years of experience 10 or 20 standard deviations away from the mean, whatever it is. That isn't possible. If the standard deviation were 16 years, ± 2 standard deviations would be a range of 64 years. That's way too high. The only reasonable choice is a standard deviation of 6 years in the distribution of years of experience.